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ABSTRACT

Three views of literature as a bond between science and English are presented. First, the view that the sciences are contributing to the restructuring of literary forms is illustrated by quotations from Nigel Dennis, Northrop Frye, Stephen Spender, Ken Kesey, and Claude Mauriac. Second, historical precedence for viewing literature as rapprochement between English and science is drawn from observations of Kenneth Rothwell, Aristotle, Marjorie Nicholson, David Cornelius, and Edwin St. Vincent. Finally, a general trend toward interdisciplinary scholarship in all fields is presently taking place. Key scientific concepts are frequently related to literary examples. (RL)

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Science and English: A Rapprochement through Literature

Edward R. Fagan

In this article, based on his speech at the NCTE meeting in Cleveland, the author describes "the role of literature as a cordial bond between science and English." Professor Fagan, a member of the faculty, School of Education, Pennsylvania State University, is the author of the recently published *Field: A Process for Teaching Literature.*

LITERATURE AS RAPPROCHEMENT between science and English is based on three major assumptions: first, that the sciences are providing foundations for restructuring literary forms; second, that there is a long historical precedence for viewing literature as rapprochement, a cordial bond, between English and science; finally, that there is a general movement in all fields toward interdisciplinary scholarship in which English is only now beginning to share. Support for these three assumptions, treated chronologically, is the focus of the material which follows.

When Nigel Dennis, British novelist and critic, reviewed Lawrence Durrell's *Alexandria Quartet* in the November 21, 1960, edition of *Life,* he unwittingly triggered a salvo of controversies about relationships between science and English. The Dennis review was not unique; other reviewers said many of the same things he did about the *Quartet.* What was unique was its appeal to a mass audience, among whom were many high school and college students. These students, intrigued and intimidated by Dennis' judgment that the relativity theory "really worked" as a new way for structuring the novel, asked both their English and science teachers to help them to discover scientific and literary ramifications of the *Quartet.*

How teachers responded to the students' questions is a moot point, but that questions having science-English dimensions were raised and will continue to be raised with increasing frequency in our technological society is a foreshadowing which we in English cannot ignore. Newer curriculum designs in the sciences, increasing miniaturization of electronic devices, newer perceptions of symbolic logic in mathematics all augur a need to expand our English perimeters. More obviously than in English, our colleagues in the humanities—painters, sculptors, musicians, choreographers—have demonstrated their responses to some of these new concepts from the sciences. Literature, on the other hand, has been limited to unilateral, word after word form. Though symbolic processes widen language horizons, these same processes by their very nature make ambiguity a hubris of the graphic medium of communication. Consequently, some scholar-critics, Northrop Frye for example, claim that only by variation within fixed perimeters can literature be modified. Yet, within the last four years novels have been published which suggest that their authors are attempting to

burst through the rubrics of classical literary forms. In almost every case the generating source of these novelties has come from the sciences.

But Stephen Spender, British poet, critic, and editor describes the limitations of science-English structures in the September 22, 1962, *Saturday Review*:

> The invention of the "interior monologue" by Joyce, the time theories of Proust, the "continual present" of Gertrude Stein have all been defended on the ground that they are inventions in literature corresponding to the theories of modern scientists.
>
> Yet in English *Finnegans Wake* is perhaps the only work which suggests a true parallel to science.

Spender's article entitled "Is a New Literature Possible?" implies a "No" answer to the rhetorical question from its very outset. Ostensibly, he supports Northrop Frye's perceptions on the same problem, namely, that structural variations in literature must be within classical boundaries. Significant in Spender's article is his avoidance of the plays, poems, short stories, and novels published within the last twenty-five years. Perhaps he feels that such literature is too recent to evaluate; if so, his decision is unfortunate, for there is strong evidence of startling changes from classical literary designs—changes which are based on principles from the sciences. Yet Spender maintains that the incomprehensibility of *Finnegans Wake* is the virtue of Joyce's work which makes it akin to the sciences. If that is the sole criterion for science-English coupling, then there are many recent, enigmatic examples of literature which have what Spender calls a "true parallel to science."

Ken Kesey's *Sometimes a Great Notion* and Claude Mauriac's *All Women Are Fatal* are two recent novels which have in common unusual designs. Kesey's design forces the reader to keep three narratives going simultaneously—a neat trick—by using visual devices of italics, capitalization, and dialect to signal various speaking voices. Readers understandably are confused at first, but once habituated, they can follow the three-in-one narrative. Simultaneity is the scientific principle involved and its meaning as described by Kesey himself is quoted from Granville Hick's critique of the book in the *Saturday Review* (July 25, 1964):

> "Time overlaps itself. A breath breathed from a passing breeze is not the whole wind, neither is it just the last of what passed and the first of what will come, but is more—let me see—more like a single point plucked on a single strand of a vast spider web of winds, setting the whole scene atingle."

Readers familiar with such scientific concepts as *complementarity, positioning,* and *relativity* can find them implicit in Kesey's thematic description of his novel. Across the Atlantic, Mauriac said almost the same thing through his narrator-novelist in *All Women Are Fatal.* "My book can be started anywhere, read and reread in any direction. Essay more than novel, an *Essay in the Form of a Novel,* perhaps."[1] Literature, by types, may not be able to sustain these statements. Nor can those who admire classical literary architecture support Mauriac's not-so-tongue-in-cheek statement about reading in "any direction" from a given focus. Yet, from a scientific perspective, Mauriac's protagonists' statements reflect concepts such as *observer viewpoint, relativity,* and *microcosm.*

Thus, literature shapes and is being shaped by scientific concepts, and this statement leaves out that mutually reinforcing genre of the two cultures, science fiction, to which the scientist turns in his search for imaginative time schemes and taxonomic systems. In today's technological climate, our integrity as scholars demands that we explore some of these new-

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[1]Leon Roudiez, "Live A Little, Die a Little," *The Saturday Review,* 47 (August 1964), p. 31.

er principles from the sciences, not to become pseudo-scientists but rather to share our professional interests so that they may become mutually reinforcing, bridging the cultures of scientist and humanist. Never has there been a better climate for using literature to provide this rapprochement, but such a judgment requires a brief historial look at the origins of the divergence.

II

Historical perspectives of literature as rapprochement between science and English are implied in Kenneth Rothwell's May 1963 *College English* article entitled "Structure in Literature." Rothwell cites from Aristotle's *Rhetoric* a statement which may have set the course for Snow's two-culture divergence. Aristotle's statement divided literature into two categories, extrinsic and intrinsic. As defined by Aristotle, extrinsic literature "focuses attention away from itself"; intrinsic literature "focuses attention back on itself." Poetry would be an example of intrinsic literature and a pamphlet or tract an example of extrinsic literature. Not leaving well enough alone, Aristotle described intrinsic literature as "true" literature; and, with that pronouncement, extrinsic literature became something other than "true" literature and inferentially, less worth of study. Notice how Aristotle's rubric undergirds Thomas DeQuincey's "literature of knowledge" and "literature of power," Wellek and Warren's "literature" and "literary study," and the new critics' "work of art" and "non-work of art," all within the nascent Aristotelian dichotomy.

Rothwell makes short shrift of the too pat nature of Aristotle's dichotomy by pointing out that reader perceptions, cultural values, and other variables had to be considered before literature could be so categorically defined. He concludes his discussion on the Aristotelian precept as follows:

> The differentiation in criticism between rhetoric [extrinsic] and poetic [intrinsic] consequently resembles the dilemma in physics over light waves and light particles.

Rothwell's allusion to physics serves as a theme-cue to the rest of his article which examines, historically, major works of English literature and then shifts to the more contemporary so-called Theater of the Absurd—the plays of Samuel Beckett, Edward Albee, Jean Genet, and Eugene Ionesco. For each of the identified eons, Rothwell suggests how the climate of the times—particularly the scientific climate—is woven into patterns of literary design. His article concludes with the following statement which focuses on the need for a unified perception of literary structure and exemplifies, metaphorically, his awareness of literature as a rapprochement:

> What has been a chaos of particles then emerges into a cosmos of patterns in which neither time nor space, nor matter nor energy, nor noun nor verb is supreme, but all elements related in a magical way to the artistic design.

That something more than Rothwell's "magical way" is involved in science-English designs is Marjorie Nicholson's thesis in her book *Science and Imagination*.[2] The "something more" is a deliberate exploration of the scientific contributions—in her case the telescope and microscope—to document the reciprocity between science and literature. In her "Preface" Miss Nicholson describes the influences of Carson Duncan's *New Science and English Literature*, a 1913 pioneer work, Alfred North Whitehead's *Science and the Modern World*, Arthur Lovejoy's *Great Chain of Being*, and frequent articles with science-literature themes in numerous issues of *PMLA* as catalysts to her interests. Miss Nicholson describes literature as rapprochement by dramatically illustrating the effects of scientific discoveries

[2]Marjorie Nicholson, *Science and Imagination* (Ithaca, New York: Cornell University Press, 1956).

during the Renaissance. Discoveries in astronomy based on mathematical calculations caused scarcely a ripple among the common people who did not understand the personal consequences of astronomers' computations. Discovery of the telescope, however, caused quite a different popular response from Renaissance man which Miss Nicholson describes as follows:

> But the telescopic discoveries of Galileo, "the man who saw through heaven," mattered profoundly. . . . The upheaval in human thought produced by the "new astronomy" is the subject of the first essays in the volume. The microscope, a natural development from the telescope, was even more readily intelligible to the layman. Its effect upon imagination is found in both prose and poetry.

Other essays in Miss Nicholson's book trace relationships between science and English from John Donne down through the late eighteenth century. In common, these essays show direct influences between scientific discoveries and the literature of the period.

One final historial reference, and one published just this year, is entitled *Cultures in Conflict*. Edited by David Cornelius and Edwin St. Vincent, this collection of essays and stories presents both sides of the F. R. Leavis, C. P. Snow controversy, then looks backward for similar conflicts in history, starting with Sir Francis Bacon and ending with Matthew Arnold's 1882 Rede Lecture, "Literature and Science," which was Arnold's reply to Thomas Henry Huxley's lecture, "Science and Culture." Other essays and stories on the science-English theme follow the historial section and represent a cross-section of origins of and reactions to Snow's two-culture conflict. By selecting and positioning their contents, the editors of *Cultures in Conflict*, intentionally or otherwise, make their publication another defense of the humanities.

The foregoing material though brief, emphasizes common historical responses to cultural phenomena made by scientists and humanists. Scientists turn to humanists for imaginative extensions of scientific principles. Humanists turn to scientists for structural modifications of literary designs. Neither culture can exist without the other, and the hyperbole used by extremists of both cultures to divide and alienate one culture from the other makes abundantly clear the need for rapprochement. Sterile, electronic worlds devoid of the qualities of compassion, understanding, appreciation are as chimerical as are worlds peopled by romantics dedicated to shibboleths of ritual, tradition, and nostalgia. While trends toward shallow specialization continue, there will also continue trends to isolate science from English. But the key word in such an augury is *shallow*, for the deeper one specializes, the more one realizes the extent to which that specialty is dependent on constellations of other so-called specialties. Albert Einstein, Niels Bohr, Norbert Weiner from physics; Kurt Koffka, Gardner Murphy, Jean Piaget from psychology; Clements, Rapoport, Sinnot from biology; all represent international leaders in their fields who—without exception—acknowledge debts to fields other than their own for extending the perimeters of their disciplines. Research emphases on areas basic to many disciplines are described as *interdisciplinary approaches* to phenomena, and it is within this frame of reference that literature seems most likely to provide a rapprochement between science and English.

III

Interdisciplinary scholarship is not new to English; the concept, *language arts*, embodies it through its interwoven reading, writing, speaking, and listening. What may be new is C. P. Snow's urgent recommendation, implicit in his *The Two Cultures and the Scientific Revolution*, that we extend our interests beyond the boundaries of our English constellation. Reasons for extending the perime-

ters of English are based on the successful outcomes of interdisciplinary programs established in the recent past. The interdisciplinary Institute for Advanced Study and The Center for Advanced Study of the Behavorial Sciences at Princeton and Stanford Universities, respectively, team teaching programs in high schools and colleges, team techniques in medicine, all reveal ritual-breaking evidence that specialists in concert are one key for unlocking the shackles of hidebound tradition. Interdisciplinary scholarship, because of its effectiveness, seems destined to become a widespread teaching philosophy in the years ahead. Reports about team teaching, the ungraded high school, programmed learning, teaching machines, computer-guided instruction and educational television describe individual and group advantages gained via this collective experimentation.

It is within this trend toward interdisciplinary scholarship that literature as rapprochement between the sciences and the humanities has its nascency. Uses of newer classroom media provide one source for interdisciplinary awareness. Users of programmed texts in grammar, in linguistics, in composition and in literature are immersed in many of the scientific concepts on which program theory is built. Members of interdisciplinary teaching teams are enmeshed in scientific concepts used by their fellow team members. From need, contact with scientific language is established; from initial contact with vocabulary, concepts are built and these, in turn, become structures for building rapprochement between science and English.

But structure, alone, is not sufficient to sustain literature as rapprochement. Equally important is process, an urgent partner for all classroom application. Process is described by Robert Frost as follows: "Let the student alone as much as possible to find out for himself."

Frost's dictum is embodied in every new science curriculum. In the Biological Sciences Curriculum Studies (BSCS), there is what is called the "black box" experiment. A sealed black box is passed from student to student until the whole class has had a chance to study the box. Data supplied by the students concerning the physical, kinesthetic, and chemical properties of the box are then used as bases for hypotheses concerning the contents of the box. Focus of the experiment is the logic and reasoning used by the students—in short, the processes—by which the generalizations are formed. In the School Mathematics Study Group (SMSG) program, we find similar exercises which require students to discover flaws in syllogisms and to derive logical propositions from given data. In English, the recommendation that we teach language concepts inductively is still another embodiment of the Frost rubric.

One consequence of the sciences' emphasis on structure and process in high schools and colleges is that students bring to their English classes these scientific principles. When this structure-process pattern is reinforced by critical reviews of literature which dwell on similar scientific principles, e.g., relativity in the *Alexandria Quartet,* we in English seem duty bound to extend our study of these transection points between English and the sciences.

Exactly which principles should we explore? Answers to that question will vary with the individual, but if we need a guide for our selection, we might start by perusing the newer curricular designs in the sciences. Within them, we would tend to find some repetition of the following terms: *ecology, entropy, field, indeterminacy, observer viewpoint, positioning, relativity, sets,* and *simultaneity.* There are other terms, but those named are the ones most likely to be used by students to analyze literature. Some of these terms, when studied as concepts, will replicate concepts from our own discipline. *Observer viewpoint,* for example, might provide a linkage with point of

view (literature), speaking voice (composition); *sets* might properly be associated with form classes from linguistics. Each of these concepts as used in the sciences has specific and narrow application within a particular frame of reference, but, in other reference frames, all are interdisciplinary.

Since we have concepts in English which closely parallel the newer concepts from the sciences, what is gained by adding scientific concepts to literary interpretation? One answer is that scientific concepts permit broader and deeper perceptions of contemporary literature. In a technological society any perception that tends to show the interrelatedness of disciplines, the mutual responsibilities toward social destiny, provides one enclave against encroaching entropy and its destructive fragmentation.

Another answer to the question was implied long ago by Samuel Taylor Coleridge in his *Biographia Literaria:*

> One man's consciousness extends only to the pleasant or unpleasant sensations caused in him by external impressions; another enlarges his inner sense to a consciousness of forms and quantity; a third in addition to the image is conscious of the conception of the notion of the thing; a fourth attains to a notion of his notions —he reflects on his own reflections; and thus we may say without impropriety that the one possesses more or less inner sense than the other.

Coleridge's statement should remind us that there are many levels to literature and that the addition of scientific concepts as tools for literary interpretation can deepen the intellectual curiosity of those who possess the capability to "attain to a notion of their notions." Like Plato's fire in the cave, the scientific-concepts approach to literature for capable readers is fresh fuel which dispels some of the shadows but, paradoxically, extends the periphery of darkness.

For less capable readers, the scientific-concepts approach possesses an aura of currency, of being a technique for the present generation. Use of the technique for contemporary readers is based on a truism: Those who are not interested in the literature of their own generation tend not to be interested in literature at all. Again history tends to support the truism from Dante through Fielding to Joyce. Today, the beatniks, the existentialists, the Theater of the Absurd, the innovators—all, deal with themes, structures, and characters which eschew tradition, particularly classical tradition. No doubt many of the innovations tried by these literary experimentalists fail; other innovations will undoubtedly become classic models for future generations. Just as the twenties were noted for the writers of the so-called lost generation—Hemingway, Dos Passos, Fitzgerald, Faulkner—the sixties may be noted for the writers of the beat generation—Ginsberg, Ferlinghetti, Salinger, Kesey, Heller. Common to these contemporary American writers and to most of the world's writers is their concern, implicit or explicit, with the role of science in man's destiny. Fiction or non-fiction automation, the bomb, population explosion, communication, conservation—and many other science-generated themes are the mark of the times. Literature, to the extent that it can enlarge understanding of the sciences while yet maintaining its own identification, can serve as an interdisciplinary link between the sciences and the humanities.

How literature performs this linkage will vary among groups, depending on factors such as: teachers' scientific backgrounds, foci of team teaching projects, students' literary experience and skill. To illustrate, let us use the "willing suspension of disbelief" for a moment and assume that a class is exploring Burdick's new novel *The 480* as literature. While objections can be raised about Burdick's skill as a writer and about the classification of *The 480* as literature, note

that on the semantic level of abstraction *The 480* can be classified as a book because it appeared on the best seller list.

Comparison and contrast, the old expository technique, might be the general method of exploration for evaluating *The 480*. Underlying the technique are two assumptions: that students know traditional structures for literary analysis and that they know something about computers. One final assumption, which as English teachers we ought to know, is that computers have a language of their own known as Fortran and that this language has a "grammar."

With the class we would seek evidence in *The 480* of organic unity, plots and subplots, point of view, and other marks of literary design. Then, we would look for design variations as implied by the content, namely computer programming and communication theory. The author's accuracy with reference to content, scientific concepts, structural innovations would be examined and systematic modifications of literary form noted. In all of this searching, students would use scientific concepts and processes to evolve techniques for examining any piece of literature.

Oversimplified, the approach to *The 480* exemplifies the mutually reinforcing roles of science and English in analyzing contemporary literature. Such an approach is neither new nor profound, but to the extent that it reinforces awareness of the sciences and their effects in today's world, to that extent it serves as rapprochement. And when we consider that contemporary examples, historical precedence, and interdisciplinary scholarship all support the role of literature as a cordial bond between science and English, we perform a mutual service for the humanities and the sciences by using it as a sentient link between the two cultures.

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